Illicit Discharge Detection and Elimination:
Introduction and Lessons Learned from Phase I

Presented At:
A Workshop for Stormwater Program Managers
Salem, Oregon
September 16-17, 2004

Presentation Developed By:

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Presentation Overview

- Terminology Review
- Phase II MS4 Requirements
- IDDE Manual Overview
- Phase I Survey Design and Participants
- Major Findings
  - Legal Authority
  - Mapping
  - Methods to Identify
  - Correcting Problems
  - Education
- Recommendations/Implications for Phase II Communities

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What is an Illicit Discharge?

- A discharge to an MS4 that is not composed entirely of storm water except permitted discharges and fire fighting related discharges

40 CFR 122.26(b)(2)

- Unique frequency, composition & mode of entry
- Interaction of the sewage disposal system & the storm drain system
- Produced from "generating sites"

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What is a Storm Sewe

- Enclosed pipe or open channel
- From a regulatory standpoint (40 CFR 122.26(b)(5)):
  - Major outfall = enclosed storm drain pipes 36 inches or greater in diameter & open channels that drain more than 50 acres
  - For industrial land uses, major outfall = enclosed storm drain pipes 12 inches or greater in diameter & open channels that drain more than 2 acres
- Minor storm outfalls are smaller than these thresholds

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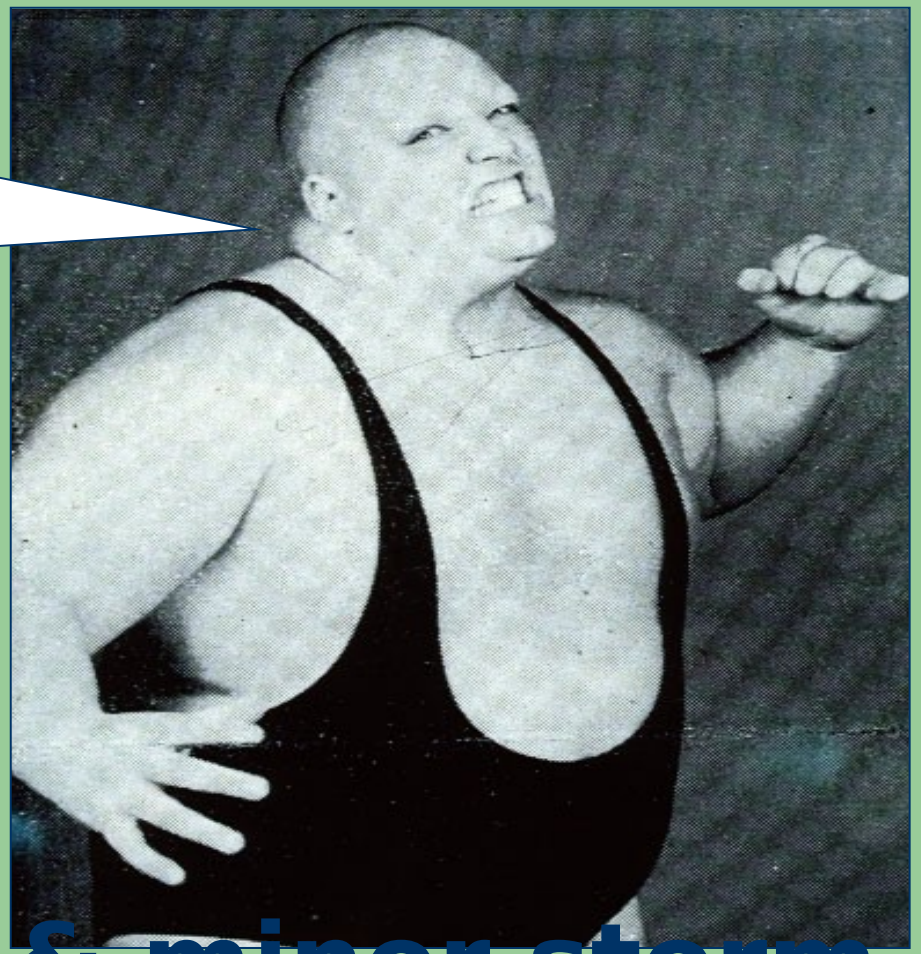
I said we **will** be counting outfalls < 6” in diameter!



Both major & minor storm outfalls can be a source of illicit discharges & both merit investigation

Discharge Frequency

- **Continuous discharges**
  - Occur ***most or all of the time***
- **Intermittent discharges**
  - Occur over a ***shorter period of time*** (e.g., a few hours per day or a few days per year)
- **Transitory discharges**
  - ***Occur rarely***, usually in response to a singular event such as an industrial spill, ruptured tank, sewer break, transport accident or illegal dumping episode

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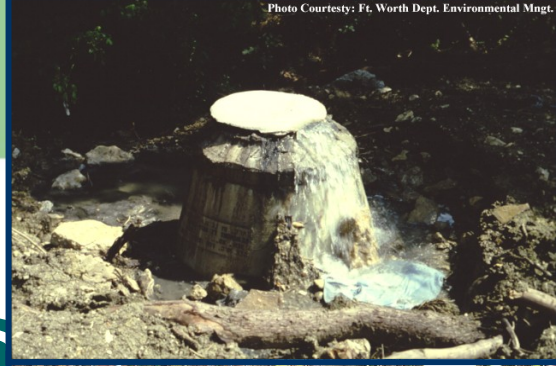
Discharge Flow Types

- Sewage & septage flows
- Washwater flows
- Liquid wastes
- Tap water *
- Landscape irrigation flows *
- Groundwater & spring water flows *

* Note: Not typically considered illicit



Mode of Entry

- ***Direct entry***
  - Sewage, industrial, commercial cross-connection
  - Straight pipe
- **Indirect entry**
  - Groundwater seepage
  - Spills
  - Dumping
  - Outdoor washing activities
  - “Nuisance” or non-target water

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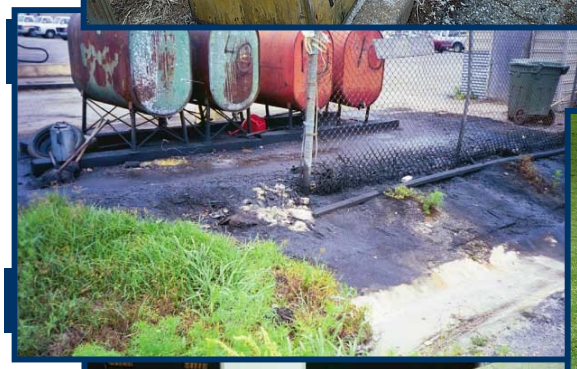
Land Use & Potential Generating

- Residential
- Commercial
- Industrial
- Institutional
- Municipal



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Land Use & Potential Generating Sites

Land Use	Generating Site	Activity Producing Discharge
Residential	Apartments Multi-family Single Family Detached Common Areas	Car Washing Driveway Cleaning Dumping/Spills Lawn/Landscape Watering Septic System Maintenance Swimming Pool Discharges
Commercial	Campgrounds/RV parks Car Dealers/Rental Car Care Car Washes Com. Laundry/Dry Cleaning Gas Stations/Auto Repair Shops Marinas Nurseries & Garden Centers Oil Change Shops Restaurants	Building Maintenance (power washing) Dumping/Spills Landscaping/Grounds Care (irrigation) Outdoor Fluid Storage Parking Lot Maintenance (power washing) Vehicle Fueling Vehicle Maintenance/Repair Vehicle Washing

Land Use & Potential Generating Sites

Land Use	Generating Site	Activity Producing Discharge
Industrial	Auto Recyclers Beverages & Brewing Construction Vehicle Washouts Distribution Centers Food Processing Garbage Truck Washouts Marinas, Boat Building & Repair Metal Plating Operations Paper & Wood Products Petroleum Storage & Refining Printing	All Commercial Activities Industrial Process Water or Rinse Water Loading & Un-Loading Area Washdowns Outdoor Material Storage (fluids)
Institutional	Cemeteries Churches Corporate Campuses Hospitals Schools & Universities	Building Maintenance (power washing) Dumping/Spills Landscaping/Grounds Care (irrigation) Parking Lot Maintenance (power washing) Vehicle Washing
Municipal	Airports Landfills Maintenance Depots Municipal Fleet Storage Areas Ports Public Works Yards Streets & Highways	Building Maintenance (power washing) Dumping/Spills Landscaping/Grounds Care (irrigation) Outdoor Fluid Storage Parking Lot Maintenance (power washing) Road Maintenance Spill Prevention/Response Vehicle Fueling Vehicle Maintenance/Repair Vehicle Washing

Phase II Program Requirements (Source: 64 FR 68722 – December 8, 1999)

- Storm sewer system map
- Regulatory mechanism (e.g. ordinance) to prevent illicit discharges
- Plan to detect & address non-storm water discharges
- Education
- Measurable goals

federal register
Wednesday
December 8, 1999
Part II
Environmental Protection Agency
40 CFR Parts 9, 122, 123, and 124
National Pollutant Discharge Elimination System—Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges; Final Rule
Report to Congress on the Phase II Storm Water Regulations; Notice

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Phase II Program Requirements
(EPA Guidance)

- Plan to detect and address illicit discharges should include:
  - Procedures for locating priority areas likely to have illicit discharges
  - Procedures for tracing the source of an illicit discharge
  - Procedures for removing the source of the discharge, and
  - Procedures for program evaluation and assessment

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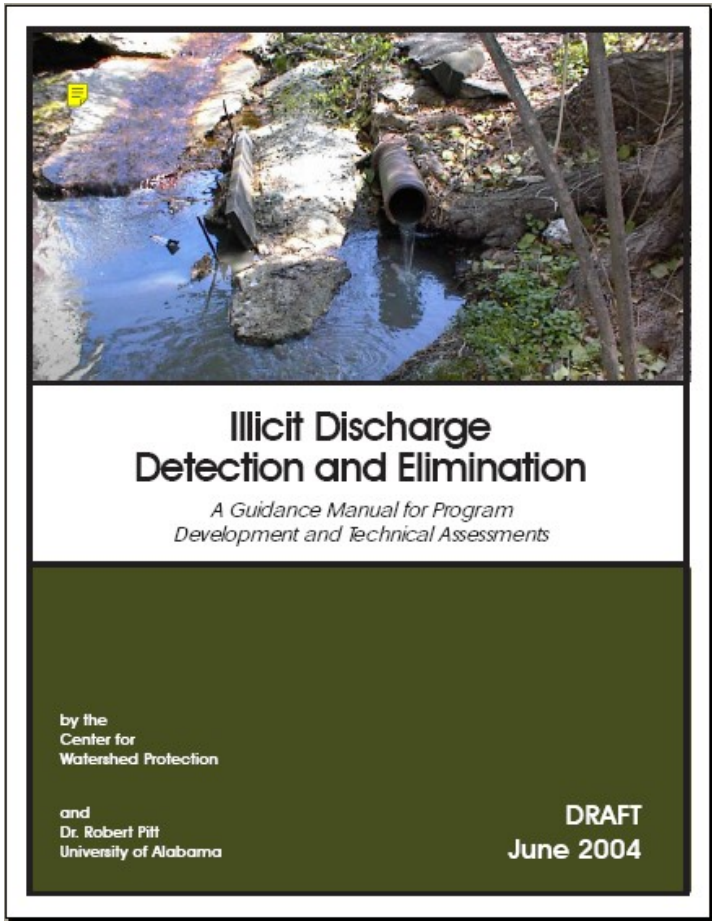
Illicit Discharge Detection and Elimination (IDDE) Guidance

- Center for Watershed Protection and University of Alabama (EPA Funded)
- 3 Part Document (Phase II MS4 emphasis)
  - Introduction
  - Programmatic Components
  - Technical Field and Lab Information
- Draft available at: www.cwp.org

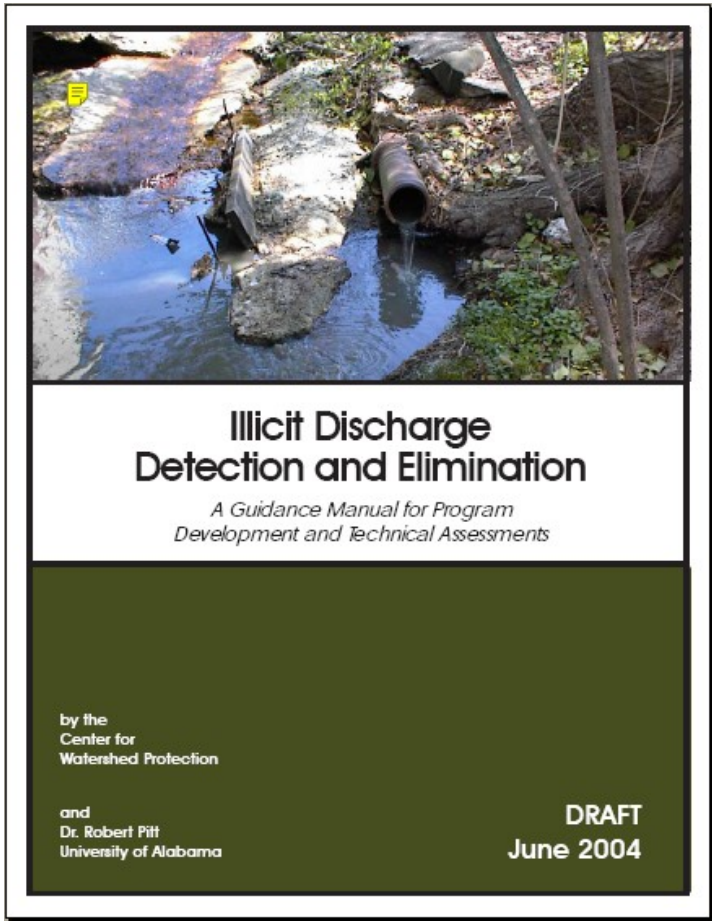
IDDE Manual – Content Overview

- Key **terminology** and **concepts**
- Conducting a needs and capabilities **audit**
- Establishing adequate **legal authority**
- Developing a **tracking system**
- Conducting **desktop analyses** to assess illicit discharge potential



IDDE Manual – Content Overview

- Conducting rapid **in-stream reconnaissance** to find problem outfalls
- **Analytical and field methods** to find and fix illicit discharges
- **Educating** municipal employees and the public to prevent discharges
- **Estimating costs** to run a program and conduct specific investigations



Design of Phase I Program Survey

- Community Characterization
- System Characterization
- IDDE Program Characterization & Cost
- Legal Authority
- System Mapping
- Methods to Identify & Confirm Inappropriate Discharges
- Inappropriate Discharge Corrections Program
- Education, Outreach, & Pollution Prevention Programs

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Survey Respondents

- 57 surveys sent
- 24 surveys completed (5 Counties, 1 Special Purpose District, 18 Cities)
- 3 additional jurisdictions submitted supporting information
- Number of respondents by EPA Region:
  - Region 1 – 3 (3 MA)
  - Region 2 – 0
  - Region 3 – 6 (3 MD, 3 VA)
  - Region 4 – 3 (1 TN, 2 NC)
  - Region 5 – 2 (1 OH, 1 MI)
  - Region 6 – 2 (1 TX, 1 NM)
  - Region 7 – 1 (MO)
  - Region 8 – 1 (CO)
  - Region 9 – 2 (1 AZ, 1 CA)
  - Region 10 – 4 (1 WA, 2 OR, 1 ID)

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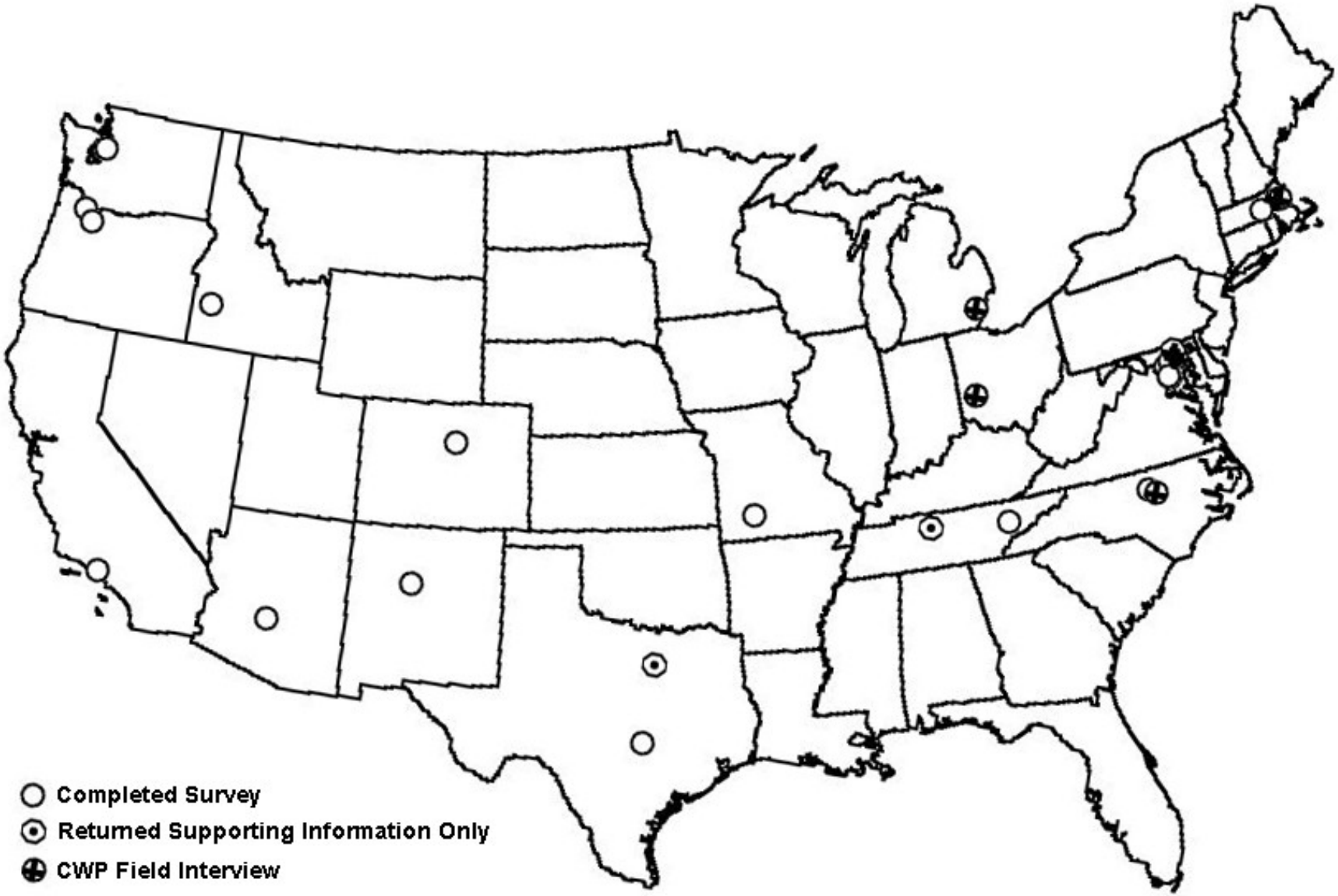
Completed Survey
Returned Supporting Information Only
CWP Field Interview

Jurisdiction Characterization

	Median	Minimum	Maximum
Population Density (people/mi^2)	2,641	175	15,000
Service Area (mi^2)	70	2	498
Total Length of Storm Drainage Network (mi)	582	81	3,500
#of Major Outfalls	250	6	7,165
Outfall / Mile of Drainage Network	0.33	0.01	3.1

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Annual Program Staffing

- Dedicated staff time ranged from 0.08 to 10 person-years, with a median of 1.5 person-years
- Difficult to quantify because:
  - IDDE responsibilities spread among many departments
  - IDDE staff also perform many other unrelated tasks and activities

The Wayne County, MI Team

The Value of Field Staff

- Typically, **67%** of program staff time is dedicated to **field work**
- Experienced field staff are a **valuable asset**
- **Lack of staff expertise** & experience is a **top problem** in identifying inappropriate discharges

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Annual Program Costs

- Total Program Expenditures
  - Range = $3,500 to $613,560
  - Median = $121,825
- Median program expenditures:
  - Staff = $85,100 (**75%** of total budget)
  - Office Computer / Software = $1,000 (**1%** of total budget)
  - Field Equipment = $4,000 (**3%** of total budget)
  - Lab Equipment / Testing = $8,000 (**5%** of total budget)
  - Other* = $10,000 (**11%** of total budget)

* educ
contra

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Sources of Inappropriate Discharges

- Illegal dumping practices (95%)
- Broken sanitary sewer line (81%)
- Cross-connections (71%)
- Connection of floor drains to storm sewer (62%)
- Sanitary sewer overflows (52%)
- Inflow / infiltration (48%)
- Straight pipe sewer discharge (38
- Failing septic systems (33%)
- Improper RV waste disposal (33%
- Pump station failure (14%)

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IDDE Program Legal Authority

- Most have legal authority necessary to inspect private properties for illegal discharges
- Few have found it necessary to invoke that authority
- Property owners are usually cooperative with respect to property inspections and achieving compliance is not usually problematic

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Common Legal Authority Approaches

- Stormwater Ordinance
  - addresses inappropriate discharges to the storm sewer system or receiving waters
- Plumbing Code
  - addresses illegal connections to the storm sewer system
- Health Code
  - regulates the discharge of harmful substances to the storm sewer system or receiving waters

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Common IDDE Program Mapping Elements

- Storm sewers (96%)
- Waters of the US receiving discharges from outfalls (83%)
- Outfalls (79%)
- Open channels (71%)
- Land use (67%)
- Sanitary sewers (63%)
- Industrial discharge permit holders (33%)
- Building connections to storm sewers (25%)
- Connections to adjacent systems (25%)
- Building connections to sanitary sewers (21%)
- Watershed, outfall drainage area boundaries (13%)
- Hotspot areas (13%)

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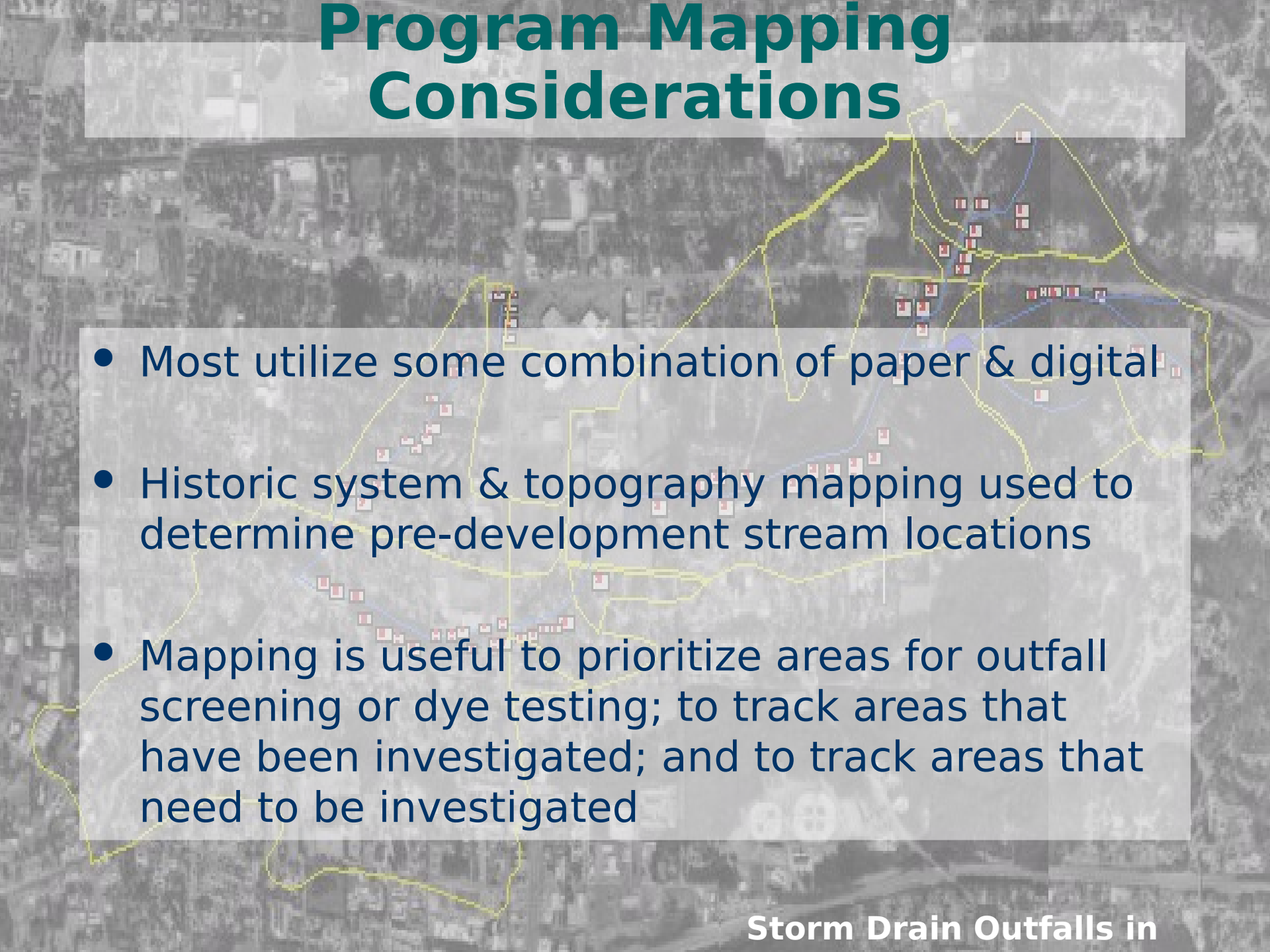
Program Mapping Considerations

- Most utilize some combination of paper & digital
- Historic system & topography mapping used to determine pre-development stream locations
- Mapping is useful to prioritize areas for outfall screening or dye testing; to track areas that have been investigated; and to track areas that need to be investigated



Storm Drain Outfalls in

Investigative Methods

- Most of the jurisdictions use **several** different methods
- Some found initial **outfall screening** successful at identifying **chronic problems**, but following screening less useful
- For **sporadic discharges**, jurisdictions are relying heavily on **hotlines** and **cross-training** of staff
- **Special studies**, **in-stream monitoring** and **targeted problem area screening** supplement efforts

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Investigative Procedures

Investigative Procedure	% of Respondents (n = 21)
Pollution reporting hotline for citizens to call	86%
Regular inspection of outfalls by jurisdiction	76%
Water quality monitoring of receiving waters	71%
Regular inspection of storm sewers	62%
Regular inspection of sanitary sewers	48%
Dye- or smoke-testing of buildings in problem areas	48%
Sporadic outfall inspection by watershed/citizen organization	38%
Regular outfall inspection by watershed/citizen organization	24%
Sporadic inspection of outfalls by jurisdiction	24%
Dye- or smoke-testing of buildings at the time of sale	5%
Water quality monitoring of discharge waters	5%
Septic system inspection at time of sale	5%

Outfall Monitoring

- Most IDDE programs conduct major outfall monitoring on a “regular basis”:
  - Screen each major outfall at least once over the NPDES Phase I permit cycle (5 years)
  - Screen each major outfall at least once a year
  - Screen major outfalls in the MS4 on a staggered schedule, based on contributing land use & history of chronic problems

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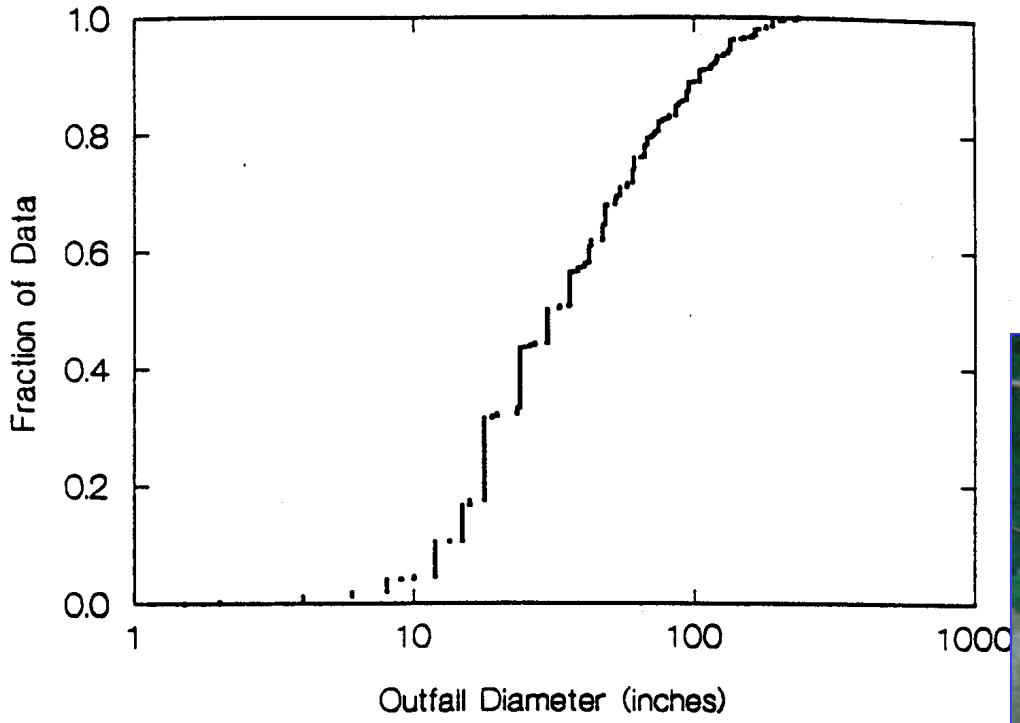
Few programs screen outfalls smaller than 36”



Small outfalls (<36”) represent 50% of outfalls in Birmingham, AL

6” Drain in Lewisburg, Tennessee

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Most Common Approach to Outfall Screening

- **Visual inspection** of the outfall
- **Qualitative** assessment of any flow present, including examination of water color, odor, turbidity, floatables, & sedimentation
- Follow-up grab sample for **quantitative** analysis, either using more sophisticated field equipment or a laboratory

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Typical Physical Indicators

- Color (95%*)
- Odor (95%)
- Deposits and stains (90%)
- Floatable matter (86%)
- Temperature (86%)
- Turbidity (76%)
- Changes in flow (62%)
- Vegetation change (62%)
- Structural damage (52%)
- Grease / oil (10%)

* % of respondents

Typical Chemical Indicators

- pH (86%)
- Chlorine (76%)
- Specific conductivity (62%)
- Ammonia / ammonium (52%)
- Surfactants (48%)
- Fecal coliform (33%)
- Fluoride (33%)
- Copper (29%)
- Fluorescence (24%)
- Phenols (14%)
- Potassium (14%)
- Detergents (10%)
- Dissolved oxygen (10%)
- Hardness (10%)
- Iron (10%)

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Many jurisdictions bypass the quantitative tests and immediately go **“up the trunk”** to find the source of the discharge

Top Problems in Identifying Inappropriate Discharge Sources

- The **source** of the discharge makes identification difficult
  - Periodic nature (76%)
  - Illegal dumping / one-time dischargers (14%)
  - Illegal connections (10%)
  - Inflow/infiltration from sanitary sewers (10%)
  - After-hours discharges (5%)

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Top Problems in Identifying Inappropriate Discharge Sources

- The MS4 **infrastructure** complicates the tracking of a discharge up the system
  - Accessibility (building, stream, outfall, traffic) (38%)
  - Complexity of network (14%)
  - Natural influences (tidal, groundwater) (10%)
  - Size of drainage basin (10%)
  - Multiple sources w/in system (5%)

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Top Problems in Identifying Inappropriate Discharge Sources

- The IDDE **program** does not have the resources available to determine the potential source of the discharge
  - Accuracy of mapping (38%)
  - Timeliness of complaint (14%)
  - Insufficient staffing (10%)
  - Insufficient expertise (5%)
  - Slow laboratory analysis (5%)
  - Unreliable equipment (5%)
  - Use of unreliable indicators (5%)

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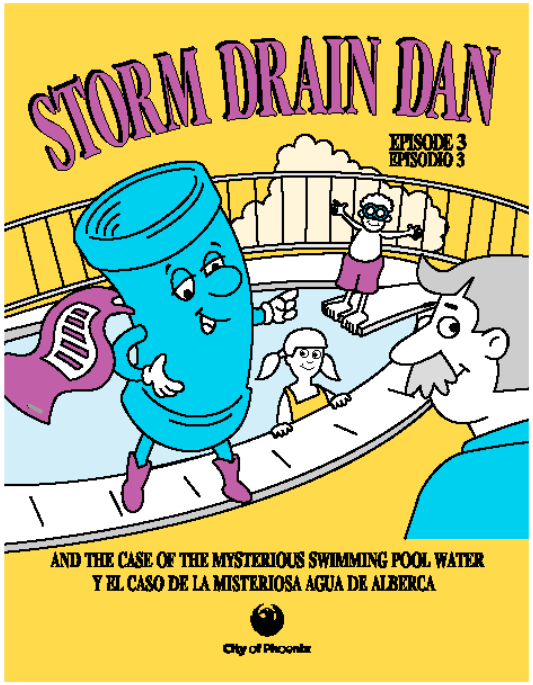
IDDE Education Target Audiences

- Resident Education (100%)
  - Storm drain stenciling, outfall signage, hotline promotion
- Schoolchildren
  - School presentations
- Commercial (95%)/ Industrial (79%)
  - Targeted at “hotspot” activity
- Public Employees (63%)
  - Field crew & inspector cross-training


STORM DRAIN DAN
EPISODE 3
EPISODIO 3
AND THE CASE OF THE MYSTERIOUS SWIMMING POOL WATER
Y EL CASO DE LA MISTERIOSA AGUA DE ALBERCA
City of Phoenix

Source: City of Phoenix, A

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Primary Conclusions

- 67% of program staff time is in field. Experienced field staff is a valuable asset.
- Budgets drive methods used by the programs to identify potential inappropriate discharges.
- Effective and comprehensive legal authority is critical.
- A good program starts with good mapping.
- Much of the field equipment is commonly available in various municipal departments.

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What this means for Phase II

- Staffing & training will be a challenge, but critical for program success. An approach that is less dependent on professional judgment is desirable.
- Ordinance language should ensure that all sources of inappropriate discharges are prohibited, and should provide the necessary legal authority to inspect private properties and to enforce corrections.
- Accurate mapping of storm sewers, open drainage channels, waters of the US, outfalls, and land use will allow field staff to conduct more effective field investigations, and will serve as a basis for prioritizing field investigations.

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What this means for Phase II

- Outfall screening can require significant resources. An efficient approach that examines a limited number of parameters at each outfall is necessary.
- Cross-training and communication with other jurisdictional programs can save money on equipment and field time.
- Accurate, cost effective, and safe methodologies need to be adopted if tracers are going to be used successfully.
- Hotlines and other education/outreach are effective tools and contribute to other Phase II measures.

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Additional Resources

- *Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems: A User's Guide* (Pitt et al., 1993)
  - **www.epa.gov/npdes/pubs/investigating_inappropriate_pesds.pdf**
- *Illicit Discharge Detection And Elimination Manual* (NEIWPPC,2003)
  - **www.neiwpcc.org/iddmanual.pdf**
- *A Guidance Manual for Identifying and Eliminating Illicit Connections to Municipal Separate Storm Sewer Systems* (Galveston County Health District, 2002)
  - **www.gchd.org/pages/pollution/GuideManual.pdf**
- The Rouge River Project Illicit Discharge Elimination Program
  - **www.rougeriver.com/techtop/illicit/index.html**

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